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AMERICAN DYESTUFF REPORTER

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Sixteen Hundred Per Cent Ad Valorem

An Editorial

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By Raefaele Sansone

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AMERICAN DYESTUFF REPORTER

A Weekly Publication devoted to

DYESTUFFS, COLORS and ALLIED CHEMICALS

"Circulated Everywhere Dyestuffs Are Used"

Vol. 8 New York, April 25, 1921 No. 17

DYES AND THE WAR INDUSTRIES BOARD

An Account by B. M. Baruch of the Measures Adopted by This Body to Protect the Industry During the War

A FINAL word concerning the advent of the American dye industry during and as a result of the World War, together with the role of the War Industries Board in helping to preserve and supply it with necessities during those critical months of its history, has appeared over the signature of Bernard M. Baruch as part of the latter's report to President Wilson made March 3 of the present year under the general title "American Industry in the War."

The opening chapters of this interesting report deal with the origin and purpose of the War Trade Board, the program of the requirements and its study of resources, and takes up the questions of priorities, conservation, price-fixing and labor problems encountered during those feverish months. The bulk of the work consists of sections devoted to the various commodities over which it exercised supervision, in which chemicals for munitions, of course, and the artificial dyes and intermediates industries, play an important part. Throughout the whole the scheme was to direct attention to the things accomplished rather than to the individuals who accomplished them, and among these things we are enabled to read again of how the prices of dyestuffs went up some 1,500 per cent due to the orgy of speculation and their essential character, and of the programs of conservation and curtailment which were adopted. The section devoted to the dye industry emphasizes well the need for preserving this industry and indicates what a struggle the country went through to win the position we have attained to-day. And in his preface Mr. Baruch recommends strongly that "through a system of stimulation by a protective tariff, a bonus, an exemption from taxation for a limited period, licensing, or any other effective means, every possible effort should be made to develop the production of manganese, chrome, tungsten, dyestuffs, by-products of coal, and all such raw materials usually imported but which can be produced in this country. Above all," he states, "immediate and persistent efforts must be made to develop the production of nitrogen and its substitutes, not

alone for war but for agricultural purposes."

There are two aspects, the report declares, to the way in which the war has brought dye manufacturing to America. When the German supply was cut off, the Americans were challenged to manufacture their own dyes. Prices were high enough to stimulate every effort. At the same time the war was demanding for the manufacture of high explosives the same chemicals in huge quantities which for the most part were the constituent materials of synthetic dyes.

Before the war Germany manufactured more than three-fourths of the world's supply of dyes, and nearly all of the intermediates used in their manufacture. This country had plants producing about 10 per cent of its consumption, but 90 per cent of the intermediates used in these plants came from Germany. Every necessary basic raw material, however, except nitrate of soda, is found in this country in abundance greater than we can use. Many of the processes of manufacture were not known here, and the Germans had fought jealously any development. In 1900 we started to manufacture aniline, but the Germans flooded our markets with aniline at a price so low that our plants never got established.

Commerce in German dyes and intermediates began to be curtailed as soon as the war broke out in Europe, and prices rose 1,500 per cent or more before the end of 1915. Two features affected prices: The fact that the shortage was so much discussed lead to an extraordinary amount of speculation; and the fact that the cost of dye enters as such a small percentage of the value of finished textiles, while the dye is itself an absolute essential, made textile manufacturers pay any price in preference to closing their mills.

Artificial dyes, called also coal-tar, aniline or synthetic dyes, are to be distinguished from vegetable or natural dyes. Natural dyes can not compete with synthetic dyes in normal times, the latter being produced at a very much lower price. The dry distillation of bituminous coal gives as products coke, ammonia, gas, and coal tar. By fractional distillation and other processes some 150 different chemicals can be derived from coal tar. The elemental derivatives, chief examples of which are benzol, toluol, creosote oil, solvent naphtha, naphthaline, xylol, anthracene and carbazol, are called in the trade "crudes." By the chemical processing of crudes the so-called "intermediates" are derived. Intermediates of higher complexity are also made from intermediates of lower complexity. Some of the best known intermediates are aniline oil, phenol (carbolic acid), salicylic acid, beta-naphthol and para-nitraniline. For example, benzol upon treatment with nitric acid gives nitro-benzol, an intermediate. Nitrobenzol upon reduction gives aniline. Aniline upon treatment with methyl alcohol gives dimethylaniline, an intermediate. Some 300 intermediates are used in making the 900 synthetic dyes known to the trade.

Very few intermediates were produced in the United States before the war, but in 1917, 134 different intermediates were made by 118 different firms. The total weight was 287,000,000 pounds, valued at $104,000,000. The synthetic phenol industry was created during the war to meet the demands for this material in the manufacture of picric acid. The synthetic process is, however, too expensive to compete with its production as a coal-tar derivative for the normal market. Synthetic dyes are built up from the intermediates.

This country manufactured dyes to the value of about $3,500,000 in 1914 and $68,700,000 in 1917. The production in 1917 equaled the pre-war importation in tonnage, but not in the variety of dyes. The azo and the sulphur dyes were made in largest amounts. Only about 3 per cent of the pre-war importation of indigo dyes was produced, and the alizarines were little beyond the experimental stage.

The most difficult period of the war for American dye consumers was late 1915 and 1916. Small amounts were brought in from Germany in exchange for shipments of cotton, but it was done with great difficulty on account of British objection. Importations from Switzerland were two or three times normal. American capital was slow in entering the producing industry, and many of the processes were protected by German-controlled patents. On September 8, 1916, a dyestuff tariff law was passed providing for a duty of 30 per cent plus 5 cents per pound on dyes with certain exceptions, 15 per cent plus 2½ cents per pound on intermediates, and placing crudes on a free list. With the passage of this law, capital turned to the industry.

The trading with the enemy act, October 6, 1917, broke the German control of patents. Under its provision the Federal Trade Commission was given authority to issue licenses under patents owned by enemy aliens. With this much protection, but under circumstances in which the manufacture of explosives was demanding every pound of coal-tar derivatives which the country could produce, the dye manufacturers built an industry which was in operation in time to save the textile manufacturing business of the country from the disastrous effects of a dye famine.

Supervision of the dye industry was from the beginning of the council an important part of the work of the Chemicals Division. The Artificial Dyes and Intermediates Section was formed in the spring of 1918, with J. F. Schoellkopf, Jr., as chief. When he entered the army in September, Victor L. King succeeded him.

Many of the constituent materials of dyes were placed under Government control during 1918—toluol, phenol, acetic acid, wood alcohol, chlorine, caustic soda, nitrate of soda, ammonia, and others. It became the problem of the section to make careful studies of the exact needs of the dye manufacturers in order to supply them with enough to encourage a development sufficient for the necessities of the textile trade and yet not subtract more than was absolutely necessary from the manufacture of explosives.

A number of programs of conservation and curtailment had to be inaugurated. Among notable examples of these are sulphide of soda, toluol, acetic acid and nitric acid. The demand for olive-drab cloth for uniforms made the consumption of sulphide of soda abnormal. Orders for olive-drab cloth for civilian use were cut to 25 per cent, and an agreement was reached with the trade to eliminate them and to eliminate the use of sulphide of soda for dyeing black hosiery, but the end came before this plan was put into operation. A saving was also effected by a rule requiring sulphide of soda to be shipped in fused form instead of crystal form, which is two-thirds water. A new method was discovered by which the quantity of nitrate of soda used in

Amanil Colors for Cotton
Union Colors for Mixed Goods
Amacid Colors for Dress Goods

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Alizarine Navy Blue
Alizarine Chrome Red
Alizarine Yellow
Alizarine Brown

Basic Colors

American Aniline Products, Inc.

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Works: Nyack, N. Y.

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Philadelphia, Pa.
Danville, Va.
Chicago, Ill.

azo dyes was cut down. The use to some extent of vinegar as a substitute for acetic acid was inaugurated.

It was the purpose of the section also to protect the industry in its relation to foreign trade. Two problems arose. A group of Swiss color manufacturers made overtures to obtain the release of certain scarce raw materials from this country under a promise to furnish finished dyes in return to the United States. This action was opposed by the section and was not carried out.

Nutgalls, imported from China, are manufactured into tannin, gallic acid and pyrogallic acid. These in turn are used for dyes for developing moving-picture films and other films and for medicinals. Shortage in shipping reduced importations, and it became necessary for the section to allocate all that arrived. In order to do this intelligently it was necessary to study the relative needs of each industry using the product and the proportion of nutgalls which should go into each of the acids, in order that each consumer might have his fair share, as the importance of his product was determined.

The close of the war left the dye industry in a favorable condition for full development. Prices of all the constituent materials were immediately reduced and many of them were a drug on the market. Toluol, which had been commandeered at $1.50 per gallon, sold in December, 1918, at 25 cents per gallon. Phenol fell from 43 cents per pound to 11 and 12 cents. The extent to which the industry had grown even before the end of 1917 is shown in the following table:

PRODUCTION OF SELECTED DYESTUFFS, 1917

Crudes:			
Benzol	gallons	..	40,600,000
Toluol	do	..	10,200,000
Solvent naphtha	do	..	3,240,000
Naphthalene	pounds	..	36,000,000
Creosote oil	gallons	..	52,500,000
Intermediates:			
Aniline oil	pounds	..	28,000,000
Beta-naphthol	do	..	5,950,000
Para-nitraniline	do	..	1,700,000
Phenol	do	..	64,300,000
Salicylic acid	do	..	3,480,000
Dyes:			
Chrysoidine Y	do	..	196,000
Chrysoidine R	do	..	58,100
Scarlet 2R	do	..	633,000
Orange 2	do	..	713,000
Bismarck brown 2R	do	..	262,000
Direct black	do	..	6,000,000
Nigrosine (spirit soluble)	do	..	302,000
Nigrosine (water soluble)	do	..	1,970,000
Indigo (20% paste)	do	..	1,690,000

W. T. B. SUMMARIZES 1920 FOREIGN DYE IMPORTS

A report on foreign coal-tar dyes for which import licenses were granted during the fiscal year ending June 30, 1920, has been issued by the War Trade Board Section of the Department of State. This was prepared by Charles S. Hawes, research assistant, and lists the name of the color, the Schultz number where available, the country of origin and the quantity in pounds.

A summary at the beginning of the report shows that licenses for 9,518,304 pounds were issued, divided among the different countries as follows: Germany, 3,721,950 pounds; Switzerland, 3,854,421 pounds; England, 1,625,543 pounds; "all other," 316,390 pounds.

The total dyes for which licenses were granted included the following classifications: Direct cotton colors, 1,690,101 pounds; basic colors, 497,231 pounds; acid colors, 2,264,055 pounds; acid colors which are true alizarines, 149,593 pounds; alizarine colors, 889,742 pounds; chrome colors, 946,155; vat colors, 1,917,222 pounds; sulphur colors, 592,322 pounds; lake colors and color lakes, 426,322 pounds; spirit and oil soluble colors, 11,972 pounds; developers and special products, 123,389 pounds; union colors, 5,775 pounds; unidentified and unclassified colors, 4,425 pounds.

Attention is called in the introduction to the fact that all the licenses issued were not used to effect actual importations. It is also noted that the figures should tend to show what dyes should be added to the dye-producing program in this country in order to place the United States in a

more independent position and to help free the country from the necessity of importing foreign dyes.

NATIONAL TO HAVE VARIED DISPLAY AT KNITTING ARTS SHOW

The National Aniline & Chemical Company, Inc., will be represented at the forthcoming Knitting Arts Exposition by an elaborate display which will present to the visitor the varied uses for which dyes bearing the "National" brand are employed in the several branches of the knitting trade.

The importance of knitted fabrics of all kinds, comprising cotton, wool, silk, artificial silk, etc., ranging from the finer textured glove material, to the heavier fabrics used for sweaters and other knitted outer garments, will be shown, dyed in all the shades that custom or fashion decrees to be right. There will also be shown an extensive array of socks, stockings, bathing suits, including yarns, etc., in all colors, and illustrating every process of the art of dyeing with "National" Dyes.

The "National" Exhibit Booth occupies spaces J, K, and L, in the center of Aisle K, and facing the visitor as he passes down the main central aisle of the hall. It will be elaborately decorated in fitting harmony with the character of the Exposition. The exhibit will be in charge of Dr. Louis J. Matos, of the technical staff of the "National," assisted by W. H. Willard of the Charlotte office, and S. W. Wood, of the Philadelphia office, together with a corps of technical men and salesmen representing every branch office of the company.

ITALIAN DYE INDUSTRY IS HARD HIT BY FLOOD OF REPARATIONS COLORS

Producers, Meeting in Protest, Declare Toll Should Be Taken in Agricultural Chemicals—Exchange Flurry Complicates Situation — Government to Aid — Reduces Import Duty on Crudes

By RAFFAELE SANSONE

Genoa, April 1.
Special to THE REPORTER.

The deliveries of dyestuffs from Germany arranged for by the Italian Government under the reparations provisions of the Treaty of Versailles, while benefiting the trades dependent on colors, succeeded nevertheless during March in upsetting very greatly the Italian artificial dye industry through placing cheaper products at the disposal of the various dyeworks and printworks. The result was that the dye industry here, which had been kept alive up to the end of 1914 only at a great sacrifice but which during the conflict had been able to extend and improve its manufactures, suddenly found itself in danger of being ruined.

Matters had reached a point where several plants producing organic pharmaceutical and coloring products were obliged to close down entirely, dismissing all employees, and the climax was

(*Continued on page* 12.)

CHEMCO FOR CHEMCO

LEVEL DYEING ACID COLORS

Consult

The Chemical Company of America, Inc.

46 Murray Street, New York City

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Pointed solely toward the welfare and growth of the American Dyestuff Industry. Unbiased contributions appreciated.

A. P. HOWES, President
LAURANCE T. CLARK, Editor

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SIXTEEN HUNDRED PER CENT AD VALOREM

You will observe on reading Mr. Sansone's interesting article from Italy, printed elsewhere in this issue, that the United States and England are far from being the only countries in which Germany's enormous capacity for producing dyestuffs efficiently and cheaply, operating in conjunction with greatly altered exchange values, exists as an ever-present threat to overwhelm the infant dye industries unless artificial protection of the most decided character is not forthcoming to equalize the difference until these industries can be built up and placed on a sound economic basis. The writer declares that when Italy's quota of reparations colors was dumped upon the domestic market, the Italian dye industry, after having been kept alive by dint of sacrifice under conditions similar to our own, suddenly found itself in danger of being ruined.

There—as if one were needed—we have an excellent example of the effects of ill-advised action with respect to these reparations dyes. To bring them into a country which is striving to create a dye industry, without exercising some sort of supervision, is simply to court the speedy destruction of that industry, and if our legislators will but turn their eyes toward Italy they will be able to see the sure consequences of leaving the American dye industry to battle single-handed against the Cartel. The dual combination of German manufacturing system and present exchange rates, either one of which would be sufficient to bring about the overthrow of a fledgling dye industry, is something with which no group of men, no matter how gifted, could hope successfully to grapple.

As one extends one's view to include the dye problem in other nations, the fallacy of the tariff idea for the protection of any of the lesser dye-making countries becomes more glaring than ever. Let us see, for instance, just how much difference there is between the exchange situations in Italy and in the United States—or rather, between the Italian and American value of German money. The lira, of course, has shrunk in value as measured against the dollar, but we can consider it from the Italian standpoint, as a unit made up of 100 centesimi. Using the U. S. dollar as the most convenient basis for comparison in both cases, the German mark in normal times would have a value in Italy of 123.31. To-day, however, its value is down to 29.5 centesimi—which shows a fall of 76 per cent in its Italian value in lire.

Now, using the dollar here as a unit made up of 100 cents, in normal times the German mark would have a value of 23.80 in this country, whereas at this writing its actual value is 1.39 cents or thereabouts, having declined 94 per cent of its American value in dollars—a mighty tumble indeed!

Leaving all other questions aside, the Italians would have to impose an ad valorem duty of 350 per cent on German color quotations merely to place things back on their old footing, while in this country we should have to fix our ad valorem duties at something like 1,600 per cent before that stupendous gap in exchange values could be bridged! And that would only be pulling up even, so to speak. After that, let the reader estimate for himself or consult Bradford Webster or other tariff exponent as to how much should be added to overcome the Cartel's striking fondness for selling at almost any loss—yes, and even practically giving dyestuffs away—in order to drive its last foreign rival through bankruptcy

proceedings. We know perfectly well that this was done in the past; that today the Cartel is quite *able* to repeat the performance, and finally, that some of its members have openly boasted that this was what they *would* do just as soon as they caught the infant American dye industry out without its governmental nurse.

The Italian Government, we learn from Mr. Sansone's article, has attempted to meet the situation temporarily by reducing the duties on imported intermediates. The dye manufacturers, for their part, are demanding that Italy take reparation in the form of some class of goods which cannot be so well supplied by home production—preferably agricultural chemicals, of which that country has not enough and of which there are no producers to speak of who would be injured by such imports. These are rather negative measures, and neither one, it will presently be discovered, travels even a respectable fraction of the distance which lies between Italy's present status and complete protection for her dye industry. The Italian Government will have to do better than that if it expects to combat the I. G.

The tariff will not do the trick in this country, although conceivably it might serve the purpose in Italy. Certainly no sane person would dream of asking the Senate to pass a measure imposing an ad valorem duty of 1,600 per cent—plus a specific duty to equalize the remaining discrepancy between normal German quotations, which are the result of a highly organized and complex system such as we have not yet developed here, and the necessarily higher prices which American manufacturers must charge for the better dyestuffs until the system is complete. The derisive shouts which would greet such a proposal may well be imagined, but even assuming, for the sake of argument, that the members of the Senate would commit themselves to such a piece of legislation—sound enough though it be

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—and then havee the nerve to run again for public office, it is still difficult to see how an adequate—and when we say adequate we *mean* adequate—tariff for protection could be fair or beneficial to the consumers of dyes in this country.

Certain of the textile interests say they are perfectly willing to have an "adequate" tariff on dyestuffs, but would object to the licensing system on the ground that it might establish a monopoly which would raise dye prices on them. Very well then, let them have their 1,600 per cent, and more. Let them write in to Washington and tell their representatives that this was what they had in mind—if they really mean what they say.

For our part, we should prefer to see them getting whatever colors they need —and cannot obtain here—from abroad at a fair price and on payment of a nominal duty. And this is exactly what the licensing system will do for them.

ITALY AND THE REPARATIONS COLORS

(*Continued from page* 9.)

arrived at when a general meeting was held in protest at the *Associazione Chimica Industriale*. Here it was vigorously pointed out that if Italy was to secure the benefits of war reparations, she could very well begin by taking as part of her share such substances as potassium salts and other fertilizing products, for which her agriculturists have always great need, and the importation of which would not damage an existing industry.

Other Complications

To make matters more difficult, foreign exchange fell suddenly, toward the middle of March, bringing the value of the United States dollar down from 27.32 lire, to 24.21 lire; the value of the English pound sterling from 106.50 to 5.92; the value of the Swiss franc from 4.55 to 4.25, and the value of the German mark from 0.44 lire to 0.40 lire. This caused a further lowering in the prices of dyes in addition to the drop already brought about by the introduction of the German colors, and rendered still more difficult the task of the Italian manufacturers of artificial organic coloring matters. Examples of the reductions per kilo in products for which a market is still open were the following: Nigrosine crystals, from 35 lire to 30 lire, and Direct Black, from 45 lire to 40 lire.

The producers of natural coloring matters also passed through difficult times, owing to a reduced demand and the sudden falling off in prices, the price of Logwood extract dropping in a few days from 11 to 10 lire per kilo, the price of Hematine crystals from 18 to 17 lire and the price of Fustic extract from 10.50 to 10. The importations of Gambier, Cutch, Cochineal, natural and synthetic Indigo, Logwood extracts and woods, Redwoods, Persian Berries, Quercitron extract and other natural colors was still very fair during March, the fall in prices causing some consumers to increase their orders.

Dyestuff Intermediates

It being, however, the firm intention of the Italian Government not to abandon the dye industry, this country is still in the market for foreign intermediates, the importing of which is to be encouraged with the provisions that all offers are to be accompanied by instructions for the utilization of the products, as well as by a statement of the purposes for which they can be employed. Offers should also be accompanied whenever possible by figures. It is felt that this policy should result in the Italian manufacturers of artificial dyes being aided and encouraged to make new ventures leading to ultimate expansion and a greater independence of foreign sources of supply. It is also stated here that foreign producers of coal tar colors will likely find it profitable to interest themselves in the production of dyestuffs in Italy. Instances of this have already occurred, notably in several cases where foreign works have sold their processes of manufacture to Italian dye works, retaining an interest in the production from these

processes. This led subsequently to the investment of additional capital in the works.

A New Royal Decree

With the purpose of assisting the manufacture of artificial dyestuffs, the Italian Government promulgated during March a Royal Decree reducing to 20 lire per metric ton the customs duty on all benzene and other light, limpid coal tar oils imported for the manufacture of artificial organic coloring materials. All such importations, however, must be adulterated at the expense of those taking part in the transactions by methods to be established by the Minister of Finance. The new law is certain to be of considerable importance to the dye industry, inasmuch as of late the price of benzene has been raised to a quite impossible and prohibitive figure through taxation. Interested parties, however, are counseled to devote some study to the question of what adulterants can best be added, to the end that the manufacturing costs of the dyestuffs to be derived from the benzene, or of intermediates produced from it, may not be unduly complicated nor rendered unnecessarily expensive.

Mordants, Assistants, Dyehouse Products, Etc.

The imports of tannic acid, aniline oil, beta naphthol, paranitraniline and vanadium salts, despite a reduction in working hours and days of work adopted by many consuming plants to meet the crisis through which all Italian industries are passing, remained good, and will in all probability register an increase during the coming months. This is indicated by the need of increasing the quantity of cotton goods dyed, and also by the probabilty of Italy extending her business in the near future to Oriental countries and South America.

SANDOZ ANNOUNCES RESUMPTION OF PRE-WAR TRISULPHON VIOLET N

McArthur, Irwin, Ltd., report that the Sandoz Chemical Works, of Basle, Switzerland, are now able to manufacture their pre-war type "Trisulphon Violet N," which corresponds to:

Diamine Violet N.....(Casella)
Dianil Violet H..... (Hoechst)
Naphtamine Violet N.....(Kalle)
Naphtamine Violet R
(Oehler-Electron)
Dianol Violet N.....(Levinstein)
Benzo Fast Violet NC.....(Bayer)

Its fastness properties include: Fastness to rubbing, good; fastness to light, good; fastness to alkali, good (under addition of soda, slightly greener); fastness to organic acid, good; fastness to washing, good. Solubility, good when dissolved hot.

Dyeing method — Light shades should be dyed under addition of 0.5—1 p.c. soap and 5 p.c. Glauber's salt; medium and darker shades with 2 p.c. soda and 10—20 p.c. Glauber's salt (an addition of soda has the effect of producing greener shades and can eventually be omitted).

Dye for ¾—1 hour with the minimal quantity of dye liquor at 140 deg. — 203 deg. Fahr. The product is

THE CERTIFIED CHEMICAL CORP. N.Y.
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MANUFACTURERS OF
Safranine
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particularly suitable for cotton dyeing in the "Jigger" and in the vat.

In Union dyeing the cotton is dyed darker and bluer than the wool.

If applied in the dyeing of half silks, Trisulphon Violet N can either be used for covering the cotton in a weak alkaline bath, or else in a soap and Glauber's salt bath for obtaining even shades on both fibers. For artificial silk, Trisulphon Violet is very useful. In printing a Hydrosulphite discharge leaves a pure white.

When dyed on wool and silk, in a neutral weak alkaline bath, Trisulphon Violet N is of good fastness to light, milling, acid and alkali."

GEIGY'S CHICAGO BRANCH IN NEW QUARTERS, WITH PROPACH AS HEAD

The Geigy Company, Inc., 89 Barclay Street, New York, has announced the removal of its Chicago branch to new quarters at 113-115 West Austin Avenue, that city. Here is maintained a warehouse stocking the products of J. R. Geigy, S.A., Basle, Switzerland, and the American plants of this firm, in quantities sufficient to cover the immediate requirements of customers, thus insuring improved and prompt service.

C. Propach, for twenty-five years identified with the territory which the Chicago branch serves, has resigned his position as manager for the Grasselli Chemical Company, Dyestuff Department, to take charge of this office. Mr. Propach's connections also include managerial positions successively with the Farbenfabriken of Elberfeld Company, the Continental Color & Chemical Company, the Bayer Company and the Hudson River Aniline & Color Works. Close application to requirements, as well as a thorough understanding of the trade, plus a completely equipped laboratory, are all important factors in the service which this branch is prepared to render.

To manufacture and deal in dyes, stains, cleaners, etc., the Lefera Blacking Company has been incorporated under the laws of New Jersey. Headquarters will be located in Newark, and the capital is given as $90,000. The incorporators consist of Frank Lafera, Newark; Charles J. Izon, Bloomfield, and Harry A. Smith and Joseph A. Smith, both of Paterson.

BEARING OF A SYNTHETIC DYE INDUSTRY UPON OUR NATIONAL WELFARE

(*Continued from last week.*)

Perhaps it will help us to visualize the ramifications of this industry more clearly if we alter our simile and liken our initial materials to a grove of trees, each one growing out of the mother earth of original sources (coal tar, for example), the branches and smaller twigs representing the intermediates and the fruit the final product, be it dye, drug, perfume or something else.

Let us step a little closer, then, and examine these trees somewhat more carefully, so as to ascertain the kind of soil upon which they grow, their relative size and spread, the nature and extent of this development, and the character of the fruit. In the brief time available this examination must necessarily be hasty, superficial and incomplete, but it will at least give us a better idea than the hazy outline we have hitherto seen only from a considerable distance.

Benzene (Benzole)

The first tree we come to is labeled Benzene, but is also called Benzole. Although benzene is the correct chemical designation, the name is unfortunate, since there is a totally different compound, obtained from petroleum, which is known as "benzine," and this often leads to confusion. We shall therefore use the term benzole in what follows. In its size, development, and in the beauty and variety of its fruit, this benzole tree is one of the monarchs of the whole grove.

The total production of all grades of benzole for the year 1919 is placed by

experts at 63,000,000 gallons; of which about 53,000,000 gallons went for motor fuel, 5,500,000 gallons were produced in the form of pure benzole and were consumed mainly by the dye industry, and 4,500,000 gallons were sold as 90 per cent benzole for use as solvent in the paint, rubber and other industries.

Thus there appears to be an ample supply of benzole in our country to permit considerable expansion of our dye production, unless other industries requiring it in large amount very markedly enlarge their demands also. The question is an important one for the dye industry, as benzole is in many respects the most fundamental of all the crudes, all the rest of which, by the way, can be made from benzole in the organic laboratory, although not commercially.

The first branch which leaves the parent trunk of benzole starts out under the name of nitrobenzole and, after one or two minor offshoots, continues as aniline, from which latter a most luxurious myriad growth springs. This nitrobenzole-aniline branch is not only the largest and most far-reaching of the entire tree, but it also has the most wonderful development and the most exuberant foliage.

Nitrobenzole is made direct from benzole by warming it with a mixture of nitric and sulphuric acids, the process being called nitration. The product is a pale yellow oil when freshly prepared, of a strong and rather rank bitter-almond odor; in fact, it was first used as a cheap perfume, under the name of oil or essence of mirbane, and small amounts are still occasionally used for that purpose. To a limited extent also it finds use in the manufacture of explosives. The great bulk of it, however, is so treated as to compel it to exchange the oxygen it contains for hydrogen, a process which the chemist terms reduction, and the nitrobenzole is thus reduced to aniline. This nitration and reduction for the manufacture of aniline are carried out mainly by the dye plants, since aniline is one of the important of dye intermediates.

As the great majority of all the early coal tar dyes owed their origin, either directly or indirectly to aniline and very closely related compounds, the name Aniline Dyes has been widely current as synonymous with synthetic dyes, and still persists, although no longer appropriate except in restricted sense.

It may surprise some of my hearers to learn that indigo is now generally manufactured from aniline, and that the amount of natural indigo imported is relatively negligible (46,878 pounds in the first six months of 1920). Indigo is probably the oldest dye known to man. It may be difficult to prove that the blue room in Noah's ark was decorated with it when he took his historic cruise, but it is scarcely to be doubted that Joseph's coat of many colors owed no small part of its brilliance to this common article, for indigo has been found in the pyramide of Egypt, in the ruined cities of Babylonia, and in the shops and houses of Pompeii. It is a product of many different plants, occurring in many countries, and has for untold ages been used by savage and civilized alike. And yet, at the present time, indigo is produced in commercially important quantities, from its natural source, in but two sections of the globe, the Bengal region of India, and Central America (Salvador). These are the last strongholds of an industry that was once world-wide. The chemist has succeeded in improving upon the leisurely and complicated processes of nature to such an extent that synthetic indigo is now produced rapidly and eco-

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nomically from aniline in any desired amount and of higher purity than the natural article. The indigo farmer, like the madder farmer and the cochineal raiser, will ultimately be compelled to turn his land to other crops—possibly to the raising of much needed foodstuffs, in the case of India.

That the chemist can in a few minutes produce what the indigo plant requires a whole season to do, I will prove by making some indigo before your own eyes from a few simple chemicals. (Experiment.)

In our country, indigo ranks second to Sulphur Black in point of consumption, but it is first in world consumption on account of the large quantities used in China. Our production in 1919 exceeded our pre-war annual imports and our domestic needs, so that large amounts were exported.

The only dye rivaling indigo in the estimation of the ancients was Tyrian Purple, or the Purple of the Ancients, a dye so expensive that in the reign of Diocletian (300 A. D.) one pound of purple wool cost about $240, which would make the dye itself worth approximately $5,000 a pound. Its use became identified with royalty, and led to such expressions as "porphyrogenitism," "born to the purple," "royal purple," and the like. The dye was obtained from certain species of sea snails (Murex), which on decomposing formed this precious coloring material. It occurs in a small sac behind the head, and forms a drop of whitish liquid when first removed. On exposure to the air and light, it changes first to green, then blue, and finally purple. If set by an alkali (soap), it becomes a fast crimson, such as ecclesiastical dignitaries still wear. Great heaps of these snail shells are still to be found outside the ancient coast cities of the Mediterranean. After the fall of Tyre, the secret of the source of this dye appears to have been lost for centuries. In 1909, Professor Friedlaender gathered 12,000 of these mollusks and by very careful work succeeded in getting a total of 1.5 grams of the coloring material, which he investigated carefully and found to be identical with a dye prepared five years previously by Sachs, but not put upon the market because of its inferiority to others already available. The interesting thing about the nature of the dye is that it is a derivative of indigo, containing two bromine atoms in place of two of the hydrogens of ordinary indigo. It is now frequently made in the organic laboratories of our universities, and I have had several of my own students prepare it at various times.

It is perhaps worth noting in passing that aniline owes its name to its having been obtained first from indigo, the Arabic name of which was "anil," or "al-nil," that is "blue stuff," by distilling the latter with caustic soda, but it took chemists for[illegible] years to find out how to produce indigo from aniline.

In 1856, the late Sir William Perkin, while endeavoring to devise a method of preparing quinine synthetically, oxidized some commercial aniline oil, and obtained instead a purplish dye, which he called "mauve," and which was the first of the modern synthetic dyes. Perkin was quick to recognize the importance of his discovery, and this became the starting point for the wonderful synthetic dye industry and the origin of the name "aniline dyes." Perhaps you would like to see this historic experiment repeated. (Experiment.)

In the case of many of the dyes described beyond as prepared from naphthalene, carbolic acid, etc., an aniline derivative is often present as one of the components of the initial mixture. Certain of the aniline dyes, in the form of lakes, are employed as pigments, as already mentioned, and a considerable tonnage of such lakes is manufactured for this purpose; others form the basis of inks and ink powders.

A further and very important use for some of these dyes is as bacterial stains, in the diagnosis of various diseases; and occasionally they are used direct as bactericides in attacking sundry ailments.

But dyes are not the only fruit we find this aniline branch bearing. If we follow out certain lateral branches from it, we shall come upon products which

are even more important, the synthetic drugs, upon which our health and even our lives may depend in times of critical illness. Among these you will find such well-known medicinals as acetanilide (antifebrine), antipyrine, arsphenamine (salvarsan), neo-arsphenamine (neo-salvarsan), cinchophen (atophan), and many others.

The history of synthetic dyes is being repeated in the case of synthetic drugs. As we are all aware, the market during the past decade has been flooded by what are dubbed the "newer remedies," most of them derived from coal tar dye intermediates, and practically all of them produced in the organic laboratory, where they were built up for the sole object of obtaining certain definite physiological results. They represent the efforts of the chemist to develop a really scientific materia medica, and the slow but sure progress in this direction is not only highly interesting, but means much to suffering humanity.

It was early recognized that the physiological action of various plants was due to certain definite chemical compounds which they happened to contain, and the first task of the chemist was to isolate, identify and study these "active principles." This study led quite naturally to attempts to reproduce artificially either these substances themselves or others of analogous structure, and to determine the particular atomic complexes responsible for the physiological effects observed. Then taking the knowledge thus gained, the chemist cut loose entirely from natural products and set about building up in his own laboratory new bodies which would contain these physiologically potent groups, and his activities in this direction are reflected in the innumerable new drugs constantly appearing. A steadily brightening light is being shed upon the connection between chemical structure and physiological action, and the physician now has at his command powerful healing drugs, which, so far as we know, are not duplicated in nature.

The natural substances are built up in the plant to play a definite role in the structure and life of those organisms, and the fact that they happen to be of therapeutic value when taken into the human system is purely fortuitous. The synthetic remedies, on the other hand, are synthesized with the specific object in view of producing substances which shall contain physiologically active groups, or so to modify a compound as to enhance its therapeutic value. It is not necessary, therefore, to construct the entire complicated molecule of an alkaloid if the same results can be secured with simpler structures, and this has been demonstrated already in many instances. In the case of the natural remedies again, other substances are frequently present which exert undesirable and even dangerous side effects. The great advantage of the synthetic drug then lies in its being a pure chemical individual, instead of a mixture of varying and uncertain content. This permits exact determination of its physiological action, accurate dosage, easy detection of adulteration and greater stability.

The life functions are essentially chemical, the cell being the laboratory, and the isolation and chemical identification of the substances formed by the organism in its endeavor to protect itself against the inroads of different diseases should show to the chemist the type of compound to be added in order to support and stimulate this action. After the drug leaves the hands of the organic chemist, it is the task of the physiological chemist to ascertain just

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what happens to it in its course through the system, and to discover if possible which one of its numerous transformation products or ions is really the one upon which its therapeutic value depends. The time is surely coming when it will be necessary only for the physician to state just what effects he wishes to produce, and the chemist can build up for him a compound which will do all that is required and be free from unpleasant side or after effects, much as the child would build up a new kind of house with the same old blocks. This probably seems to you an extravagantly optimistic view, but if you will consider for a moment what has already been accomplished in this direction I am sure that you will share my enthusiasm. It takes years to solve such problems, of course—von Baeyer worked twenty years upon the molecular structure of indigo, but he finally solved the mystery.

The popular superstition that the medicinal value of a pure chemical compound is modified in some obscure but positive manner by the source from which it is derived, is as old as the hills. The famous "English drops," a drug which really consisted of nothing but ammonium carbonate with a little ethereal oil, sold for high prices up to the close of the seventeenth century, because it was stated by some that the ammonium it contained was obtained by the dry distillation of silk, while others even went so far as to maintain that it was prepared by distilling five pounds of the skulls of persons who had been hanged (or who had come to some other unnatural end) with two pounds of dried vipers, hartshorn and ivory. We smile, and yet this same kind of superstition still retains its hold upon the community and has materially retarded the introduction of really valuable synthetic remedies.

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Dye-a-Grams

This column extends its best wishes to the partnership formed by Stolt & Wallace, of Du Pont's Boston office.

—o—

"A Lost Opportunity"—*"Reporter" editorial.* We were quite pleased, after reading this, to discover that it was only an editorial we had lost!

—o—

We note advertisements signed "Aniline Sales Corp." and "Certified Chemical Corp." Well, if the Dye bill isn't passed soon, some of our firms may be adding an "se" to their signatures! (Deep, what?)

—o—

Latest: "An optimist is a Scotchman running around New York with a corkscrew in his pocket."

—o—

"Drys in Washington will nip beer plan in the bud"—*news item.* Bud—so to speak—weiser!

—o—

New Englanders *do* look in the dictionary once in a while, despite a general belief to the contrary.

—o—

What has become of the old-fashioned Longworth bill of—so it seems—our forefathers?

—o—

ALIBI

April air is mild and hazy;
Ambition it dismisses.
Thus one scribbles, dull and lazy,
Such pallid junk as this is!

G. E. T.

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"One hundred ninety-one firms reported a total of 24,736 employees engaged in the manufacture of coal-tar products, 2,605, or 10.5 percent. were chemists or engineers. This is probably a larger proportion of technically trained men than will be found in any other important manufacturing industry in the U. S."—*United States Tariff Commission Report.*

The reason for this preponderance of technicians is that each step in the intricate synthesis from the lump of coal to the brilliant dyestuffs must be under the constant observation of chemical engineers.

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Du Pont Dyestuffs are what they are, because some 4,000 earnest workers labor for their excellence, and of this number 470 are chemists or technically trained men.

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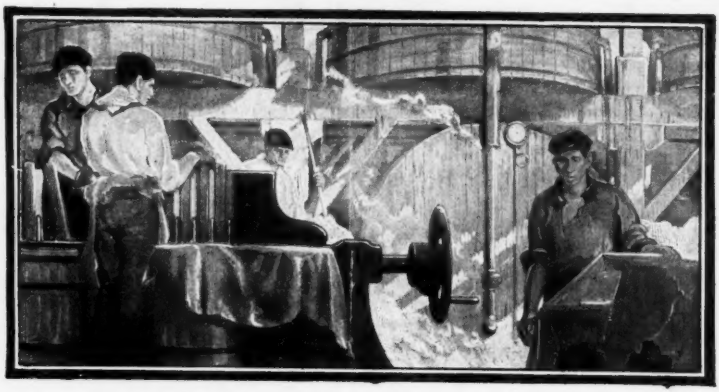

The Dye-making Industry—Emptying a Filter Press. *From a Mural painting by Arthur Covey.*

THE Knitting Arts Exposition to be held in Philadelphia early in May will show the advance made in this important branch of the textile trade.

Among the features of the Show will be the exhibit of this Company where will be found samples of dyeings of Hosiery, Knit Goods, Sweaters, etc., colored with "National" Dyes.

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